March, 13, 2013

ATTACHMENT A - Scope of Services

2013 Pavement Condition Survey of the City of Durham Street System

Prepared For:

Marvin V. Williams, Director
City of Durham, Department of Public Works
101 City Hall Plaza, 3rd Floor
Durham, NC 27701-3329

Prepared By:

Howard Luxhoj, PE
President President/CEO
Transmap Corporation
3366 Riverside Drive, Suite 103
Upper Arlington, OH 43221

Scope of Services Outline

Introduction

Project Team

Task 1 - Project Setup and Management

- Task 1a – Proposed Project Schedule
- Task 1b – Maps of the Streets Included in the Survey
- Task 1c – Project Kick-Off Meeting
- Task 1d – Mobilization
- Task 1e - Pavement Management Practice Definition
- Task 1f – MicroPAVER Network Setup
- Task 1g - Project Management

Task 2 - Pavement Condition Survey

- Task 2b - ON-SIGHT Data Collection - Streets
- Task 2c – ON-SIGHT Data Collection – Alleys
- Task 2c – Pavement Condition Index (PCI) Rating - Streets
- Task 2d – Pavement Condition Index (PCI) Rating – Alleys
- Task 2e - Advanced Inspections - Profilometer Data Processing
- Task 2f - Advanced Inspections – Additional Street Data
- Task 2g - Pavement Distress Data QA/QC
- Task 2h - Pavement Survey Report

Task 3 - Additional Data Collection, Software and Training

- Task 3a - Advanced Inspections – Curb Cut and Sidewalk Data
- Task 3b – Falling Weight Deflectometer
- Task 3c - MicroPAVER Data Migration
- Task 3d – MicroPAVER Software
- Task 3e - MicroPAVER Training
- Task 3f - LizardTech LIDAR Software
- Task 3g - Azteca CityWorks/MicroPAVER Software
- Task 3h- Azteca CityWorks/MicroPAVER Training
- Task 3i - Installation Assistance on City's GIS Servers

Fee Summary

Appendix A - PCI Study Sample Area and Location Protocol

Introduction

This document describes the scope of services to be provided by Transmap to the City of Durham Department of Public Works for the 2013 Pavement Condition Survey of the City of Durham Street System.

Project Team

The table below lists the principal members of the project team for the City of Durham Department of Public Works (CODPW) and Transmap.

Name	Project Role	Telephone	Email
City of Durham Department of Public Works			
Michael M. Hughes, PE	Project Manager	919-560-4326 *30266	michael.hughes@durham.gov
Tasha N, Johnson, PE	Assistant Director	919-560-4326 *30262	tasha.johnson@durhamnc.gov
David E. Cates, PE, GISP	GIS Supervisor	919-560-4326 *30232	david.cates@durhamnc.gov
Transmap Corporation			
Howard Luxhoj, PE	Project Principal	614-481-6799	hluxhoj@transmap.com
Craig Schorling, GISP	Project Manager	614-537-6297	cschorling@transmap.com
Chris Crocker	Assistant Project Manager	614-481-6799	ccrocker@transmap.com

Task 1 - Project Setup and Management

The first four tasks related to Project Setup, 1a through 1d in the lists and paragraphs below, need to be performed prior to Task 2 the "Pavement Condition Survey". Tasks 1e and 1f, "Pavement Management Practice Definition" and "Network Setup and Review", respectively, need to be performed before Task 2c "Pavement Inspection – Streets". Task 1e, Project Management, will be continuous through the duration of the project.

Task 1a – Proposed Project Schedule

Upon execution of the Contract, Transmap will receive a Notice to Proceed to develop a detailed project schedule which will address the following tasks and milestones:

1. Task 1 – Project Setup and Management
    a. Project Schedule
    b. Maps of the Streets Included in the Survey
    c. Kick-Off Meeting
    d. Mobilization
    e. Pavement Management Practice Definition
    f. MicroPAVER Network Setup
    g. Project Management

2. Task 2 – Pavement Condition Survey
    a. ON-SIGHT Data Collection – Streets
    b. ON-SIGHT Data Collection – Alleys
    c. Pavement Inspection - Streets
    d. Pavement Inspection – Alleys
    e. Advanced Inspections - Profilometer Data Processing
    f. Advanced Inspections - Additional Street Data
    g. MicroPAVER Data Migration
    h. Pavement Survey Report
3. Task 3 - Additional Data Collection, Software and Training
    a. Advanced Inspections – Curb Cut and Sidewalk Data
    b. Falling Weight Deflectometer
    c. MicroPAVER Data Migration
    d. MicroPAVER Software
    e. MicroPAVER Training
    f. LiDAR Compressor Software (LizardTech)
    g. Azteca CityWorks/MicroPAVER Software
    h. Azteca CityWorks/MicroPAVER Training
    i. Installation Assistance on City's GIS Servers

The project schedule will include the planned start and finish dates for each task or activity, and the task/activity relationships (F/S), (S/S) etc. The calendar used to develop schedule will include holidays, weekends (no work on Sundays) and a provision for rain days where it affects the work to be performed. Once the Project Schedule has been submitted to and accepted by CODPW, Transmap will be issued a Notice to Proceed with the other tasks and project activities.

Estimated Cost 10 man-hours @ $99.00/man-hours = $990.00
Estimated Expenses = No Charge

Task 1b – Maps of the Streets Included in the Survey

Transmap will prepare a series of maps for the kick-off meeting that will provide the basis for the street network to be included in the Pavement Condition Survey.

Estimated Cost 20 man-hours @ $99.00/man-hours = $1,980.00
Estimated Expenses = No Charge

Task 1c – Project Kick-Off Meeting

The project kick-off meeting will be held in the CODPW offices. Transmap will have the appropriate personnel attend the meeting in person. The goals for the kick-off meeting are as follows:

1. Review the project schedule,
2. Discuss reporting requirements and expectations,
3. Discuss technical details as necessary,
4. Codify team member responsibilities.
5. Finalize the street network to be included in the Pavement Condition Survey.

Estimated Cost 15 man-hours @ $99.00/man-hours = $1,485.00
Estimated Expenses = No Charge

Task 1d – Mobilization

Transmap will mobilize the ON-SIGHT™ system to Durham and establish the ground control and quality control networks. The purpose of the ground control network is to provide the GPS corrections necessary to ensure sub-meter data collection is established and maintained throughout the duration of data collection activities. Mobilization activities include the following:

1. Deploying a Transmap ON-SIGHT™ mapping vehicle, equipment and staff (driver and operator) to the City of Durham,
2. Press Release - Transmap will prepare a draft release for the City that will describe the vehicle that will be mapping with license plate information.
3. Installing, configuring, and calibrating the camera equipment and on-board data management hardware/software,
4. Installing, configuring, and calibrating the on-board global positioning and inertial navigation system equipment
5. Setup the Quality Control (QC) network.

Estimated Cost 32 man-hours @ $99.00/man-hours = $3,168.00

Estimated Expenses = No Charge

Task 1e - Pavement Management Practice Definition

This task is two-day a fact-finding meeting to be held at CODPW. The purpose of the task is to establish the parameters which form the basis of the "Pavement Survey Report", Task F. In addition the legacy data, if any, to be incorporated in the final report will be identified and discussed.

This activity is necessary to establish the various pavement preservation technologies and repaving and reconstruction practices, which will be considered going forward. These technologies in-turn provide the basis for the maps and the analysis of various alternatives for inclusion in the "Pavement Survey Report". The current maintenance and rehabilitation (M&R) practices as well as those to be considered in the future will be codified. Transmap will use this information to gather regional cost data for the alternative methods of pavement practices to be used in the "Pavement Survey Report".

The list below represents some of the elements to be covered in this activity.

- Functional classification – The class or group of streets that a street belongs to. MicroPAVER uses the following classes:
    - o Principle,
    - o Arterial,
    - o Collector,
    - o Industrial,
    - o Residential,
    - o Primary,
    - o Secondary,
    - o Tertiary
- Traffic count data
- Budgets – the projected City of Durham pavement rehabilitation budgets in the planning horizon.
- Material costs - Typical cost of materials for rehabilitation.
- Pavement preservation practices - Types of pavement preservation, repaving, or reconstruction practices the City has under consideration, such as :
    - o Microsurfacing,
    - o Cape seals,
    - o Slurry seals, etc.
- ArcGIS Online site - Transmap media site. Transmap will host the geodatabase data in the cloud. This site is created to assist in the tracking of the project deliverables.

- Overall digital centerline file - We will review the final centerline file that was provided to Transmap by the City. This is a GIS file.
- Construction dates - The historical pavement preservation practices per street facility ID.

Estimated Cost 2 Days @ $1,750.00 = $ 3,500.00
Estimated Expenses = No Charge

Task 1f – MicroPAVER Network Setup

Intrinsically as described in Task 1e, MicroPAVER operates on a hierarchical organization of street blocks known as the pavement network. Transmap will define the network, branch, section, and PCI sample locations in MircroPAVER that will be used as the foundation for the Pavement Management System. In addition, Transmap will define any additional data fields that the City wants to be able to access in MicroPAVER. The PCI sample section criteria for consideration in this project are discussed in Appendix "B".

Estimated Cost 12 man-hours @ $99.00/man-hours = $1,188.00
Estimated Expenses = No Charge

Task 1g - Project Management

The following Project Management Services will be provided by Transmap during the life of the project;

1. Update the project schedule
2. Provide monthly status reports
3. Allocation of Transmap resources to complete project tasks
4. Overall coordination of project between the City and Transmap

Estimated Cost 107 man-hours @ $99.00/man-hours = $10,593.00
Estimated Expenses = No Charge

Task 2 - Pavement Condition Survey

Task 2b - ON-SIGHT Data Collection - Streets
Task 2c – ON-SIGHT Data Collection - Alleys

Transmap will drive the street network to be surveyed using the ON-SIGHT™ HD mapping vehicle. This vehicle is equipped with high-definition cameras, point cloud laser (vehicle-based LiDAR), inertial navigation system, multiple GPS antennas and a pavement profiler.

The specifics of the data to be collected by the ON-SIGHT™ HD mapping vehicle are as follows:

- An image database will be collected for each street in both directions enabling a full 360-degree view (one-way streets excluded) of the roadway.
- If a one way street is over two lanes wide, Transmap will drive the street twice in the same direction. Once in the right most lane and once in the left lane.
- The image database will be collected for alleys in only one direction. The alleys are driven in the same manner as a one way street. The images will be collected in the direction of travel. The ROW camera will be positioned on the right side of the vehicle. The forward facing camera should be able to pick up any asset on the left side due to the smaller width of the alley.
- Image spacing (horizontal distance between image sets) will be 13.1 feet for both streets and alleys.

- Three on-board cameras will be used to obtain the image database.
    - One camera faces directly forward in the vehicle travel direction
    - The second forward facing camera has a 45-degree offset to the right for right-of-way images
    - The third camera faces the rear and is pointed downward. The images from this camera are used to collect the PCI pavement distress data.
- An ASTM E950 Class 1 pavement profiler is attached to the vehicle to collect International Roughness Index (IRI), rut data and cross slope information continuously.
- The point cloud laser (LiDAR) gives real-time positioning of assets within the roadways. Point cloud data is useful for measuring heights, offsets and intensity of assets. Transmap uses this data as another tool to collect roadway assets. The LiDAR is positioned over the 45-degree camera and will be collected in the travel direction just like the image database.

Transmap will QC the images obtained by the mapping vehicle to ensure that they are satisfactory and to meet the objective of the right-of-way asset and pavement inventory project. To ensure the highest quality images, image capture activities will not be performed during low-light or adverse weather conditions. In-field image quality control will be performed for the purpose of identifying groups of images that may be unacceptable for feature extraction. Unacceptable images will be re-collected.

The specified route network will be compared against that of which has been imaged to ensure that no route segments have been overlooked. Missing route segments will be re-driven and imaged. Route segments may not be imaged when they are not accessible due to construction, temporary or permanent closures. If a route segment does not exist, such as a paper street, data will not be collected.

Positional accuracy will be maintained and verified through the use of QC points established within the road network. Reference coordinates will be established for said QC points. QC point locations will be derived from the collected images; with discrepancies between the known reference coordinates and the measured coordinates (from the images) noted. Ninety percent of the derived horizontal coordinates within 35 feet from the imaging vehicle will fall within 1 meter of the known reference coordinates. If 10 percent or more of the selected control points do not meet the accepted accuracy criteria, corrective actions will be taken. The route will be driven again if the accuracy criteria is not accepted.

Transmap has reviewed the City's GIS centerline file. Based on this analysis the preliminary estimate is that there are 697 centerline miles of streets to be surveyed and 5 centerline miles of alleys to be surveyed. The costs for the data collection survey are below.

Street Survey Cost: 697 centerline-miles @ $99.00/centerline-mile = $ 69,003.00
Alley Survey Cost: 5 centerline-miles @ $99.00/centerline-mile = $495.00

Task 2c – Pavement Condition Index (PCI) Rating - Streets
Task 2d – Pavement Condition Index (PCI) Rating - Alleys

Transmap will collect the data necessary to provide a Pavement Condition Index (PCI) Rating for each street or alley segment. The data will be stored in MircoPAVER where the ratings are calculated, as well as exported to the GIS street centerline data. The protocol for the PCI Rating will be based on the specifications and methodologies described by ASTM Standard D6433-11 "Standard Practice for Road and Parking Lots Pavement Condition Index (PCI) Surveys".

Transmap uses a unique *hybrid* approach to capture the pavement distress (condition) data proscribed by the ASTM Standard D6433. Through the use of photogrammetry Transmap will measure widths, lengths and square footage of all surface distress data required to develop the PCI Rating. Pavement distresses for each sample area will be documented through the use of a digital pavement condition rating form

designed to capture the distress type, severity, and frequency directly within the established pavement condition data model following ASTM standards for surface distress collection.

The following table reflects the distress types that Transmap will collect for at each sample location in the project. Transmap uses a cost savings approach to conduct the distress collection. We have over 18 years of pavement distress collection experience and we collect the most commonly seen distress types for Cities like Durham. Other distress types that do not occur commonly are not collected. Also, these distresses do not greatly affect the overall PCI score because they do not have a high deduct value in MicroPAVER. The distresses listed below occur commonly in Cities and have high deduct values in MicroPAVER. Please see Appendix C of this proposal for a description of how the size "sample locations" is determined.

Asphalt Pavement Distresses	
Distress	**Description**
Alligator Cracking	Fatigue cracking that consists of a series of interconnecting cracks formed by repeated traffic loading
Potholes	Holes that are formed from alligator cracking
Transverse/Longitudinal Cracking	Cracks that are longitudinal or transverse in nature, which form for a variety of reasons
Edge Cracking	Cracking along the edge of the roadway
Weathering	The wearing away of the asphalt binder and fine aggregate
Raveling	The dislodging of coarse aggregate particles
Block Cracking	Interconnected cracks that form blocks typically caused by the hardening of the asphalt surface
Patching & Utility Cut Patching	An area that has been replaced with new material to repair existing pavement
Road Profiler Data	
Ride Quality	Vehicle vibrations - 0 is no vibrations
Rutting	A surface depression in the wheel path caused by repeated traffic load. Recorded values will be delivered as min, max and average rutting

Concrete Pavement Distresses	
Distress	**Description**
Slab Count	Number of slabs present within section
Slab Width	Width of concrete slabs
Slab Length	Length of concrete slabs
Corner Breaks	Edges of slabs broken
Patching	Patching present in concrete
Divided Slab	Slabs divided into four or more pieces
Linear Cracking	Transverse/Longitudinal cracks that are divided into two or more pieces

As mentioned previously, Transmap has reviewed the City's GIS centerline file. Based on this analysis the preliminary estimate is that there are 697 centerline miles of streets to be surveyed and 5 centerline miles of alleys to be surveyed. From this analysis Transmap has calculated that based on a PCI sampling frequency of one sample every 300 feet, with a minimum of one sample per block, there are 12,204 sample locations in the streets, and 79 sample locations in the alleys. The costs for the PCI Rating are below.

Street PCI Rating Cost: 12,204 sample-locations @ $5.88/sample-location = $ 71,759.52
Alley Survey Cost: 79 sample-locations @ $5.88/sample-location = $ 464.52

Task 2e - Advanced Inspections - Profilometer Data Processing

A unique element of the Transmap *hybrid* approach to capture the pavement distress is how the ride quality and rut measurements will be provided by the laser profiler. The E950 approach uses a standard pavement profilometer which records the profile of the traveled surface. This method uses measurements of the distance between an inertial plane of reference and the traveled surface; along with the acceleration of the inertial platform in order to detect changes in elevation of the surface. Transmap uses International Cybernetics Corporation (ICC) sensors for our vehicle Rut and Ride equipment. We have worked together for over 10 years. ICC has met or exceeded all State Highway Class 1 testing requirements.

The International Roughness Index (IRI) and rut data will be collected for the left wheel track, the right wheel track, and the average of the two wheel tracks in a manner which meets all ASTM E950 standards. The equipment captures continuous pavement data as the vehicle drives along a roadway at user specified intervals (1" up to 18"). Lasers are placed in each wheel path and in the center of the wheel paths to give the rut depth. The rut depth will be delivered as minimum, maximum, and average per wheel path. The IRI data will be delivered as a value over the whole section of pavement. The IRI data represents the total anticipated vertical movement a vehicle would experience over a given stretch of road. The data acquired from the profiler will be processed and loaded into MicroPAVER and delivered as a field in the centerline file segment by segment as listed in the table above.

Advanced Inspections - Profilometer Data Processing Cost: Lump Sum = $ 9,990.00

Task 2f - Advanced Inspections – Additional Street Data

The additional data to be collected as described below will collected and stored in MicroPaver for each street segment. The data reported shall be typical of the street segment unless otherwise noted. Where the data varies measurably within the street segment, the data at multiple locations will be provided within the street segment.

1. Pavement Width
    a. The width of the asphalt pavement will be measured and recorded in MicroPAVER as part of the base scope of services. However, in many streets in Durham the pavement width can vary substantially within a block, as a result,
    b. If the pavement width varies, the street will be stationed and the pavement width at each transition shall be measured and reported.
2. Type of curb and gutter
    a. Granite Curb (with brick gutter)
    b. Concrete Curb – Soldier Course curb (gutter material varies)
    c. Valley (or roll) Curb and Gutter – Specify Width if evident (gutter not paved over)
    d. NCDOT Curb and Gutter – Specify Width if evident (gutter not paved over)

3. Curb and Gutter in need of repair or replacement. Identify by address, physical reference, or stationing as appropriate.
    a. Vertical/Horizontal Misalignment due to subgrade failure
    b. Spalling or structurally inadequate concrete
    c. Damaged (likely due to utility work or traffic loads)
4. Depth of gutter pan
    a. Typical in the block – measured as inches from TOC
    b. Make multiple measurements if the depth of gutter pan varies significantly within the block. Identify by address, physical reference, or stationing as appropriate.
5. Cross-slope of each street
    a. Measure at each intersection with pedestrian crossings where they exist.
    b. If there are no pedestrian crossings measure typical cross slope at representative locations (likely driveway connections) within the block. Identify by address, physical reference, or stationing as appropriate.
    c. Data to be reported
        i. Percent slope from crown to gutter – measured as inches to gutter via string line with line level. String held on grade at crown, tape measure vertical distance from level string line to gutter, measure to horizontal distance and convert to slope and report as percent.
        ii. Note parabolic sections (non-linear) where they exist.
6. Drainage issues where apparent. Identify by address, physical reference, or stationing as appropriate.
    a. Locations along the street that are trapping water
    b. Locations where there are pavement failures due to, or are causing, ponding
7. Extreme utility adjustments (valve boxes, manholes, catch basins, etc) which need immediate attention. Examples of this are where a manhole is in the traveled area of the pavement and it is out-of-adjustment by several inches (there are numerous examples of this in Durham due to subgrade shrinkage) causing a potential travel hazard by causing a driver of a vehicle to lose control. Identify by address, physical reference, or stationing as appropriate (Treat, analyze and log as a pot hole or inverse pot hole) Clarification?

Additional Street Data Cost: 697 centerline-miles @ $67.00/centerline-mile = $46,699.00

Task 2g - Pavement Distress Data QA/QC

Through Transmap's many projects, we have adopted a walk-out field verification method to ensure accurate distress data analysis. This method uses additional inspections when needed. Transmap will use boots-on-the-ground when samples are flagged for additional verification and inspection. Samples will be flagged in areas where pavement distress is excessive and high or it is flagged for any other reason.

The cost for the QA/QC task are included in the PCI Tasks 2c and 2D above $no charge

Task 2h - Pavement Survey Report

During the boot camp task, Transmap will collect the data necessary to assist in the reporting task. We will have an understanding of which reports the City needs from the Management Practice Definition. The reporting will have different scenarios that will be delivered.

Reporting scenarios:

a. Branch (entire road average) condition report
b. Overall PCI report by segment
c. Pavement distress report (distresses by segment)
d. Worst-first approach according to City budget
e. Do-nothing map based on City defined/APWA maintenance activities (year 1 and year 5)
f. Recommended (APWA) and City maintenance activities with budgets for first year

These reports will allow the City to see how creating logical candidate lists and maps will help in evaluating treatments based on PCI and deterioration models.

Deliverables:

a. Printed reports in binder for City records
b. GIS maps
c. Reporting web page for review and future download of maps

Estimated Cost 44 man-hours @ $99.00/man-hours = $5,500.00
Estimated Expenses = No Charge

Task 3 - Additional Data Collection, Software and Training

Task 3a - Advanced Inspections – Curb Cut and Sidewalk Data

The additional data to be collected as described below will collected for each street segment. It will be stored in a GIS feature-class specifically for this data; it will not be stored in MicroPAVER. The data reported shall be typical of the street segment unless otherwise noted. Where the data varies measurably within the street segment, the data at multiple locations will be provided within the street segment.

1. Curb Cut (ADA Ramps)
    a. Location
    b. Truncated Dome (yes, no, color)
    c. Integrate existing City curb cut data with Transmap collected data
2. Sidewalk
    a. Where it exists the sidewalk will be identified on each side of the street. The following data will be collected about the sidewalk according to the "Citywide Sidewalk Inventory Condition Assessment Scale" listed below:
        - Width (<3' or >3')
        - Class 1
        - Class 2
        - Class 3
        - Class 4
        - Class 5
        - Class 6

Cost Included in 2f Advanced Inspections

Task 3b – Falling Weight Deflectometer

Transmap can supply the client with project-level FWD testing with our trailer mounted KUAB 2m-FWD dynamic impulse loading device. The KUAB meets or exceeds all requirements of ASTM standard test method D 4694-96 and the SHRP calibration protocol for FWD equipment. A typical FWD set up is listed below:

a. At each test location, we will perform a seating load, followed by three impact load tests.
b. Impact load levels that will be used are 9,000 lbf seating followed by a 6,000, 9,000 and a 12,000 lbf load. The 9,000 lbf is the standard load for analysis of pavements.
c. The FWD has nine deflection sensors. The recommended spacings of 0", 8", 12", 18", 24", 30", 36", 48" and 60" from the center of the 12" diameter load plate will be used.
d. Transmap will analyze the results and attach the results as weak, moderate, or strong to the City centerline file and database.

Falling Weight Deflectometer (~30 lane miles) - 1 day : Lump Sum = $ 6,000.00

Task 3c - MicroPAVER Data Migration

Transmap has written scripts for automated loading of the City's centerline file and distress data into MicroPAVER. Transmap loads MicroPAVER twice during the project. Once the initial pavement analysis is complete, Transmap will run results through MicroPAVER to establish a raw Pavement Condition Index (PCI). After the initial load, Transmap will perform our field verification walk-out. After the walk-out, distress data may be updated and re-run though MicroPAVER to establish a final PCI for delivery. The second time will be after the walk-out is complete and after all of the IRI and rut data has been processed.

Estimated Cost 11 man-hours @ $99.00/man-hours = $1,089.00
Estimated Expenses = No Charge

Task 3d – MicroPAVER Software

Through APWA, Transmap will purchased the most recent copy of MicroPAVER pavement management software for the City. Currently, MicroPAVER is on release 6.5.4. The initial purchase of MicroPAVER comes with 3 seats of software and one year of technical support from APWA. At the request of the City, Transmap will purchase an additional 12 seats of the software and one year of technical support. This would be a total of 15 seats and 2 years of technical support.

MicroPAVER Software : Lump Sum = $ 2,145.00

Task 3e - MicroPAVER Training

Transmap will setup the City with a 2-day on-site training of MicroPAVER 1 and a 3-day MicroPAVER 2 training. This training is for up to 5 people from the City and will cover the basic MicroPAVER functions to the advanced reporting solutions within MicroPAVER. The training will be performed on the City's actual data that is collected during the project. The City will supply a computer for each trainee and Transmap will load MicroPAVER on each computer. The City will provide the room where the training will take place. The class will cover:

a. Overview of Paver - Selection tools and drop downs
b. Inventory - Network, surface type, user defined fields
c. Work Tracking - History, construction dates
d. PCI Field Inspection/Data Entry
e. Standard Paver Reports
f. Prediction Modeling
g. Condition Analysis

h. System Tables
i. Work Planning

Onsite MicroPAVER Training Cost 5 days @ $2,000/day = $10,000.00
Estimated Expenses = No Charge

Task 3f - LiDAR Compressor (LizardTech Software)

Transmap will purchase LiDAR compressor software from LizardTech . This software compresses LiDAR LAS files into MrSid files for viewing in ArcGIS or LizardTech GeoViewer (free). Training on this software is straightforward and in most cases, the user simply loads the file, previews, and encodes. The software comes with 1 year technical support form LizardTech.

Software description:

a. Software enables the user to turn point cloud data sets into efficient MrSID files that are 25 percent or less of the size of the raw data, yet retain every return.
b. User can change compression ratio

LizardTech Software : Lump Sum = $ 2,499.00

Task 3g - Azteca CityWorks/MicroPAVER Interface Software

Transmap will purchase a seat of the Azteca CityWorks/MicroPAVER Interface Software for the City. The initial purchase of the software comes with one year of technical support from Azteca Cityworks.

Azteca CityWorks/MicroPAVER Software : Lump Sum = $ 4,995.00

Task 3h - Azteca CityWorks/MicroPAVER Software Training

Training on the MicroPAVER interface software from Cityworks will be done via webinar in one day. A representative from Transmap will be on-site at the City to assist in the setup of the training. The first part of the training will cover implementation of the software. The rest of the training will cover the basic functions of the software and how it interfaces with MicroPAVER and the City's existing Cityworks database

Web Based Azteca CityWorks/MicroPAVER Training Cost
1 days @ $1,480/day = $1,480
Estimated Expenses = No Charge

Task 3i - Installation Assistance on City's GIS Servers

Transmap will host all images for the length of the project and for 6 months after project completion. After 6 months, Transmap will assist the City in migrating the images to their servers.

Migrating process:

a. Media will be delivered to the City on internal SATA hard drive
b. Transmap will update image link to City location
c. Transmap can deliver the code for image viewer
d. Web-based and on-site support

During the MicroPAVER on-site training, Transmap will install MicroPAVER within the City. During the web-based Cityworks training, Cityworks will assist in the installation of the MicroPAVER interface.

Estimated Cost 25 man-hours @ $99.00/man-hours = $2,475.00
Estimated Expenses = No Charge

Fee Summary

			Units	Estimated Quantity	Unit Rate	Estimated Cost
Task 1 - Project Setup and Management						
	1a	Proposed Project Schedule	man-hours	10	$99.00	$990.00
	1b	Maps of the Streets Included in the Survey	man-hours	20	$99.00	$1,980.00
	1c	Kick-Off Meeting - Labor	man-hours	15	$99.00	$1,485.00
		Kick-Off Meeting - Expenses	lump sum		*** no charge ***	
	1d	Mobilization	man-hours	32	$99.00	$3,168.00
		Mobilization - Expenses	lump sum		*** no charge ***	
	1e	Pavement Management Practice Definition - Lab	days	2	$1,750.00	$3,500.00
		Pavement Management Practice Definition- Exp	lump sum		*** no charge ***	
	1f	MicroPAVER Network Setup	man-hours	12	$99.00	$1,188.00
	1g	Project Management	man-hours	107	$99.00	$10,593.00
		Task 1 Sub-Total				$22,904.00
Task 2 - Pavement Condition Survey						
	2a	ON-SIGHT Data Collection - Streets	centerline miles	697	$99.00	$69,003.00
	2b	ON-SIGHT Data Collection - Alleys	centerline miles	5	$99.00	$495.00
	2c	Pavement Inspection - Streets	sample location	12,204	$5.88	$71,759.52
	2d	Pavement Inspection - Alleys	sample location	79	$5.88	$464.52
	2e	Advanced Inspections - Profilometer Data Processing	lump-sum	1	$9,990.00	$9,990.00
	2f	Advanced Inspections - Additional Street Data	centerline miles	697	$67.00	$46,699.00
	2g	Pavement Distress Data QA/QC	sample location	610	*** no charge ***	
	2h	Pavement Survey Report	man-hours	44	$125.00	$5,500.00
		Task 2 Sub-Total				$203,911.04
Task 3 - Additional Data Collection, Software and Training						
	3a	Advanced Inspections - Curb Cut and Sidewalk Data	centerline miles	697	**included in curb price	
	3b	Advanced Inspections - Falling Weight Deflectometer	days	1	$6,000.00	$6,000.00
	3c	MicroPAVER Data Migration	man-hours	11	$99.00	$1,089.00
	3d	MicroPAVER Software	lump sum	1	$2,145.00	$2,145.00
	3e	MicroPAVER Training including expenses	days	5	$2,000.00	$10,000.00
	3f	LizardTech LIDAR Software	lump sum	1	$2,499.00	$2,499.00
	3g	Azteca CityWorks/MicroPAVER Software	lump sum	1	$4,995.00	$4,995.00
	3h	Azteca CityWorks/MicroPAVER Training	lump sum	1	$1,480.00	$1,480.00
	3i	Installation Assistance on City's GIS Servers	man-hours	25	$99.00	$2,475.00
		Task 3 Sub-Total				$30,683.00
					Total Project Cost	$257,498.04

Appendix A – PCI Study Sample Area and Location Protocol

PCI Sample Definition – The PCI Sample area is the lowest order of the defined pavement network. All samples must belong to a network, branch and section.

Sample Areas Dimensions and Sizes
The ASTM Standard D6433-11 protocol indicates that sample areas should be representative of the pavement condition in the segment being evaluated and that they should be between 1,500 square feet (SF) and 3,500 SF in size.

For a fixed sample size the length of the sample area depends on the width of roadway. For this project Transmap proposes the sample areas as listed in the table below as a function of the pavement width. The image collection is set for 13 foot intervals, hence the number of images in each section from which the pavement distresses will be quantified.

Width	Number of Images	Length	Square Footage
<12	14	182	1456 – 2002
≥12 and <22	10	130	1560 – 2730
≥22 and <32	6	78	1716 – 2418
≥32	4	52	1664 – 4160

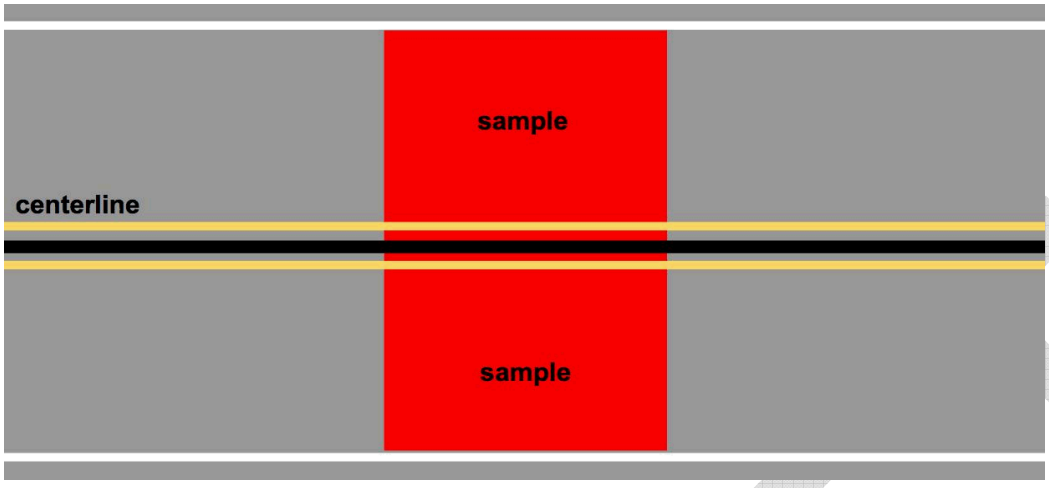
Transmap will not perform any pavement inspections at the center of intersections. All sample areas will be offset from intersections and will be representative of the overall conditions within the street segment.

Sample Locations
The sample locations need to take into consideration the number of travel lanes. For the case where there are two lanes the sample area will encompass the width of the road and the corresponding length from the table above.

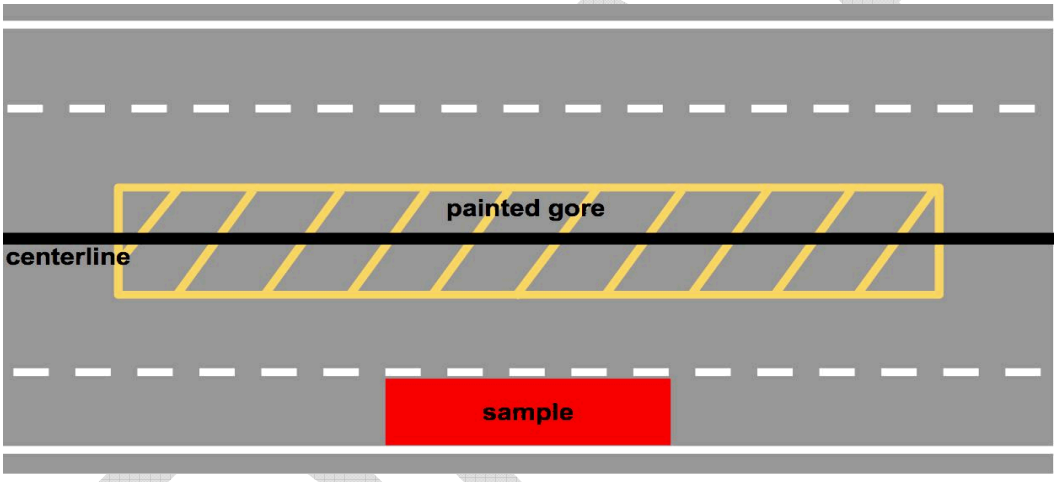
In cases where there are multiple lanes Transmap proposes that the sample area be located in the rightmost thru lane. In this case, the width of the lane width will be used to determine the length of the sample area based on the table above. If there is a median in the sample area that divides for a roadway, each half of the street will be treated as its own route and the sample area dimensions will be as described above.

The sample area locations proposed by Transmap for this project as a function of different typical section are illustrated in the examples below.

Example 1 - Standard Street and Sample Area
The following example is the standard sample layout for roads with two lanes.



Example 2 - Four Lane without a Divided Median
The following example shows the sample location in the rightmost thru lane.



Example 3 – Divided Median (Two or Four Lanes or more)
The following example shows two sample locations in the rightmost lane either side of the divided median.